

From: [Willy Gayle](#)
To: [Tracy Simmons](#)
Cc: [Warren Henry](#)
Subject: RE: Meeting to discuss C-V2X waiver with Maryland State Highway Administration
Date: Thursday, April 28, 2022 10:56:28 AM
Attachments: [image001.png](#)

Tracy,

MDOT SHA RESPONSES:

Please review DA 21-962 footnote 10 and provide answers if C-V2X RSU or OBUs are unable to comply with existing ITS rules.

PN certifications and questions that need clarification

(1) a certification that there are no existing ITS licensees authorized to operate within the same geographic area in which the waiver applicant seeks to operate, OR certification that the waiver applicant has coordinated with every existing ITS licensee licensed (in whole or part) within that same geographic area to ensure that the waiver applicant's C-V2X-based roadside unit operations will not interfere with any DSRC-based roadside units operating in the 5.895-5.925 GHz band;

1. **How will C-V2X deployment co-exist with DSRC licensed in the state and in adjacent areas?**

Maryland is adjacent to the following states: Pennsylvania, Delaware, West Virginia, Virginia, and the District of Columbia. The Maryland Department of Transportation State Highway Administration (MDOT SHA) has searched the FCC ULS database in these states for IQ licenses and notified all operators that C-V2X systems are being deployed. MDOT SHA will request to be notified in the event of interference. The notice should contain the LAT/LONG of the impacted sites. Interference tests will allow MDOT SHA to reduce power transmitter output or antenna modification.

2. **Has there been any testing?**

Not yet. MDOT SHA is waiting on the approval of the waiver request in order to start testing. When we are able to test, we will verify communications between the RSU and the test vehicles and compare DSRC to C-V2X. However, to date, there are no C-V2X standards for comparison.

3. **If there is a report of interference, how would it be addressed?**

MDOT SHA searched the ULS database for IQ licensees in Maryland and adjacent states. MDOT SHA will notify current licensees that C-V2X RSUs are installed and operating. MDOT SHA will request to be notified in the event of interference. The notice should contain the LAT/LONG of the impacted sites. Coordinated interference tests will allow MDOT SHA to reduce transmitter

power output or install a directional antenna.

4. **What is the schedule for RSU deployment with C-V2X technology?**

Field installation of the ITS devices will be complete in the next 4-6 months.

(2) a certification that the waiver applicant's C-V2X operations will comply with the existing technical rules (e.g., including, but not limited to, power and out-of-band emission limits) for DSRC-based technologies other than the portion of the current rules requiring use of DSRC-based technologies;

1. **Clarify what technology is being deployed "C-V2X" — do they mean the 4G-LTE C-V2X, or 5G-NR C-V2X**

MDOT SHA will be deploying 4G-LTE C-V2X systems.

2. **Waiver mentions the C-V2X technology will combine channels 182 and 184. That does not comply with the current DSRC rules. What is the technical bandwidth and emissions for this C-V2X equipment?**

To use channels 182 and 184 combined to create channel 183 the following provides a technical detail for intended use of the combined channels:

C-V2X equipment authorized pursuant to the requested waiver parameters will operate in the 5905-5925 MHz band using a 20 MHz channel. The transmit power for C-V2X OBUs would not exceed 33 dBm EIRP. OBUs are expected to use 20 dBm (*i.e.*, 100 mW) conducted power measured at the antenna input. These limits conform with FCC Rule Section 95.3189, "OBU technical standard,"¹⁵ which requires DSRC OBUs to comply with the technical parameters in IEEE 802.11p-2010. Section I.2.2, "Transmit power levels" and Tables I.4 and I.5a in the 802.11p-2010 standard permit a maximum transmit power level of 44.8 dBm EIRP for government vehicles and 33 dBm for non-government vehicles; conducted power may be up to 760 mW measured at the antenna input.

The transmit power level for C-V2X RSUs also would not exceed 33 dBm EIRP, which is less than maximum average power permitted in the 5905-5925 MHz frequency range under FCC Rule Section 90.377, "Frequencies available; maximum EIRP and antenna height, and priority communications."¹⁶ This limit is consistent with FCC Rule Section 90.379, "Technical standards for Roadside Units,"¹⁷ which require DSRC RSUs to comply with the technical parameters in IEEE 802.11p-2010. IEEE 802.11p-2010 Section I.2.2, "Transmit power levels" and Table I.4 permit a maximum transmit power level of 44.8 dBm EIRP, which is 11.8 dBm higher than the power level requested in this waiver application. In addition, C-V2X RSU installations would comply with Table Note 1 in Rule Section 90.377 that restricts the height of RSU installations, as presented in the attachment. The OOB limits for C-V2X OBUs and RSUs presented in the

attachment are consistent with the 802.11p standard as well.

3. **Does this C-V2X equipment meet the DSRC rules and who is making the certification the equipment complies with existing technical rules.**

For C-V2X equipment to meet technical rules as published in Subpart M rules for DSRC, compliance with current rules cannot be assured. However, current C-V2X RF hardware does comply with many of the DSRC rules, including out of band emissions. Please see below.

Out-of-band emission (“OOBE”) limits: ○ An OBU or RSU operating in the above 20 MHz channel shall comply with the OOBE limits for C-V2X shown below. Transmit power spectral density (PSD) measurements shall be made using a 100 kHz resolution bandwidth and a 30 kHz video bandwidth.

Frequency offset (MHz from Channel edge)	OOBE PSD offset relative to 33 dBm/20 MHz (or 10 dBm/100 MHz)	OOBE PSD for C-V2X transmissions (dBm/100 kHz)
0.0	-26.0	-16.0
1.0	-32.0	-22.0
10.0	-40.0	-30.0
20.0	-50.0	-40.0

○ OOBE Measurements will be conducted and with reference to allowed EIRP (33 dBm). Maximum allowable peak antenna gain = minimum ((allowed EIRP- certified transmit power), minimum margin to spectral mask) + cable loss.

Note 1: The frequency offsets match those required for a 20 MHz 802.11p channel and the OOBE PSD offsets in the middle column match those required for DSRC.

Note 2: Since C-V2X transmission bandwidth and in-band PSD are adaptive, it is more prudent to apply an absolute mask for C-V2X OOBE PSD as shown in the rightmost column in lieu of the relative mask used by DSRC.

(3) a certification that the applicant’s operations will be revised to the extent necessary to comply with any final rules that the Commission adopts for C-V2X operations; and

1. **How is the equipment updated to comply with the final C-V2X rules?**

RSU products can be updated to comply using a firmware application.

(4) a certification that the applicant’s C-V2X operations will be limited to transportation and vehicle safety-related communications.

1. What transportation and vehicles will get the updated OBUs?

Currently, the plan is for the State of MD vehicles to borrow OBUs from the Turner Fairbanks Highway Research Center (TFHRC). The state vehicles will be using these RSUs to "test" this pilot technology. As the technology matures, BSMs and SPaT messages will be transmitted to the general public vehicles/ OBUs that are capable of receiving and transmitting these messages.

2. Is the state testing with any other government agency or company granted under an experimental license?

No, the state is not testing with any other government agency or company granted under an experimental license.

3. How do you limit the C-V2X technology from going outside your state?

Our focus is to deploy RSUs within the state, with limited and localized use of C-V2X based OBUs. Therefore, there are a limited number of locations where the C-V2X technology is deployed/ planned to be deployed within the state. All locations are within MDOT SHA's jurisdiction and none are close to neighboring state borders. Hence, the usage is strictly limited to Maryland.

Thanks!

Willy Gayle

Assistant Division Chief

ITS Division

Office of Transportation Mobility and Operations

Maryland Department of Transportation, State Highway Administration

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From: Tracy Simmons <Tracy.Simmons@fcc.gov>
Sent: Tuesday, April 26, 2022 5:25 PM
To: Willy Gayle <WGayle@mdot.maryland.gov>
Cc: John Evanoff <John.Evanoff@fcc.gov>; Thomas Reed <Thomas.Reed@fcc.gov>; Roger Noel <Roger.Noel@fcc.gov>; Jamie Coleman <Jamie.Coleman@fcc.gov>; Michael Ha <Michael.Ha@fcc.gov>; Paul Murray <Paul.Murray@fcc.gov>; Joshua Smith <Joshua.Smith@fcc.gov>; Ira Keltz <Ira.Keltz@fcc.gov>; Jim Szeliga <Jim.Szeliga@fcc.gov>; Muli Kifle <Muli.Kifle@fcc.gov>; Shel Leader <shel@sleader.com>; Ronald E. Williams <Ronald.Williams@fcc.gov>; Warren Henry <whenry@mdot.maryland.gov>
Subject: RE: Meeting to discuss C-V2X waiver with Maryland State Highway Administration

Mr. Gayle, would it be possible to get an update on your response?

Tracy Simmons
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Public Safety and Homeland Security Bureau
Federal Communications Commission
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Tracy.Simmons@fcc.gov

From: Willy Gayle <WGayle@mdot.maryland.gov>
Sent: Wednesday, April 13, 2022 1:25 PM
To: Tracy Simmons <Tracy.Simmons@fcc.gov>
Cc: John Evanoff <John.Evanoff@fcc.gov>; Thomas Reed <Thomas.Reed@fcc.gov>; Roger Noel <Roger.Noel@fcc.gov>; Jamie Coleman <Jamie.Coleman@fcc.gov>; Michael Ha <Michael.Ha@fcc.gov>; Paul Murray <Paul.Murray@fcc.gov>; Joshua Smith <Joshua.Smith@fcc.gov>; Ira Keltz <Ira.Keltz@fcc.gov>; Jim Szeliga <Jim.Szeliga@fcc.gov>; Muli Kifle <Muli.Kifle@fcc.gov>; Shel Leader <shel@sleader.com>; Ronald E. Williams <Ronald.Williams@fcc.gov>; Warren Henry <whenry@mdot.maryland.gov>
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Tracy,

Thanks for you help. I will get back to you with our response.

Thanks,

Willy Gayle
Assistant Division Chief

ITS Division

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Mr. Gayle, we appreciate you taking the time to answer our questions. I have included all of the FCC contacts from PSHSB, WTB and OET on this email that were invited to the meeting. A list of questions raised during our discussion is listed below. We would appreciate if you could respond to these questions by the end of next week (4/22).

Please review DA 21-962 footnote 10 and provide answers if C-V2X RSU or OBUs are unable to comply with existing ITS rules.

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Please contact me if you have any questions.

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